International Journal of Teaching and Learning (INJOTEL) e-ISSN: 3025-8308
Vol. 2 No. 10, October 2024, pages: 2916~2925

THE EFFECT OF INTERACTIVE POWERPOINT (PPT) WITH THE ICEBERG APPROACH ON UNDERSTANDING MATHEMATICAL CONCEPTS IN THE TOPIC OF SURFACE AREA OF A CYLINDER

Nadya Ramadhani *
Medan State University
nadyaramadhani1999@gmail.com

Nur Hidayah Br Karo
Medan State University
nurhidayahbrkaro@gmail.com

Hamidah Nasution
Medan State University
hamidah_mat67@yahoo.com

Abstract

This study aims to analyze the effect of using interactive PowerPoint (PPT) with the Iceberg approach on students' understanding of mathematical concepts, specifically in the area of cylinder surface area. Students' difficulties in comprehending abstract geometrical concepts necessitate a more effective learning approach. The research employed a quasi-experimental design with pre-test and post-test on two groups: an experimental group using interactive PPT with the Iceberg approach, and a control group using conventional teaching methods. The sample consisted of 60 eighth-grade junior high school students. Results showed a significant improvement in concept understanding for the experimental group compared to the control group, with normalized gain values of 0.78 and 0.37, respectively. T-test analysis revealed a significant difference between the two groups ($t = 5.05$, $p < 0.05$). A student perception questionnaire indicated that 83% of students found learning more engaging with interactive PPT. In conclusion, the use of interactive PowerPoint with the Iceberg approach effectively enhances students' understanding of mathematical concepts related to cylinder surface area and increases their learning motivation.

Keywords: Interactive PowerPoint (PPT); Iceberg Approach; Mathematical Concept Understanding; Cylinder Surface Area

INTRODUCTION

Mathematics education has an important role in shaping the ability to think critically, logically, and systematically in students. However, mathematics is often considered a difficult and challenging subject for many students, especially when it comes to abstract concepts such as geometry. One of the materials in geometry that is often a challenge for students is the surface area of the tube. Many students have difficulty understanding the relationship between the tube-forming elements (base, blanket, and height) and their surface area formula. According to research conducted

by Indriani (2015), students' understanding of this concept is often limited to memorizing formulas without a deep understanding of the process or meaning behind the formula.

To overcome this problem, a learning approach is needed that can bridge between abstract concepts and concrete experiences that are easier for students to understand. One strategy that can be used is to apply technology-based interactive learning media, such as interactive PowerPoint (PPT), which is equipped with the Iceberg approach. Interactive PPT media offers visual and animated displays that can help students visualize abstract concepts in a more concrete way, while Iceberg's approach, which is part of the Realistic Mathematics Education (RME) theory, provides a gradual process in understanding mathematical concepts, ranging from concrete to abstract (Gravemeijer & Doorman, 1999).

Interactive PowerPoint is not just a static presentation tool, but rather a dynamic medium that allows students to actively engage in learning through interactive features such as simulations, animations, and live evaluations. According to Aloraini (2012), the use of interactive PPT in mathematics learning has been proven to increase students' interest in learning and understanding because it presents material in an attractive and easy-to-understand visual form. Interactive PPTs make it easier for teachers to convey complex material, such as geometry, in a simpler, visual, and interactive way. In the context of learning the surface area of a tube, visualization through interactive PPT can clarify the relationship between the elements of the tube and its surface area formula, so that students not only memorize the formula, but also understand the concept behind it.

Meanwhile, the Iceberg approach is a gradual approach used to help students build a conceptual understanding from concrete to abstract experiences. Iceberg describes how the part of a concept seen by students is only a small part of the overall structure of a larger mathematical concept (Van den Heuvel-Panhuizen, 2003). This approach allows students to first understand the basic aspects of a concept through real activities or visual representations, before finally moving on to more abstract concepts. In the case of the surface area of the tube, this approach can begin with a real activity such as making a tube model out of paper or visualizing the tube meshes, before students are invited to understand a more abstract mathematical formula. Research by Zulkardi and Ilma (2006) supports the effectiveness of Iceberg's approach in improving understanding of mathematical concepts, as it provides a strong concrete foundation before introducing abstraction.

The use of interactive PPT combined with Iceberg's approach in learning geometry is expected to help students better understand the concept of tube surface area. Not only does it facilitate understanding through visualization and interaction, but it also provides a gradual process that facilitates students in building a deep and sustainable understanding. In line with the multimedia learning theory proposed by Mayer (2009),

learning that combines visual and verbal elements at the same time can increase students' absorption of learning materials, especially for visual topics such as geometry.

However, although there have been many studies that have shown the effectiveness of technology-based media and the Realistic Mathematics Education (RME) approach, studies that specifically examine the effect of the use of interactive PPT with the Iceberg approach on the surface area of the tube are still limited. Therefore, this study aims to fill the gap by exploring the extent to which the use of interactive PPT with the Iceberg approach can improve students' understanding of concepts on the surface area of the tube.

The formulation of the problem in this study is based on the difficulty of students in understanding the concept of the surface area of the tube and the importance of using more interactive and effective learning media. In this context, the main issue to be discussed is whether the use of interactive PowerPoint (PPT) with the Iceberg approach can significantly improve students' understanding of mathematical concepts on the surface area of the tube. In addition, this study will also examine the effectiveness of using interactive PPT media with the Iceberg approach compared to conventional learning methods, as well as explore students' perception of the use of technology-based learning media in the mathematics learning process.

The purpose of this study is to analyze the influence of the use of interactive PowerPoint (PPT) with the Iceberg approach in improving students' understanding of mathematical concepts, especially on the surface area of the tube. In addition, this study also aims to evaluate the effectiveness of this method compared to conventional learning methods, as well as explore how students perceive the use of interactive PPT with the Iceberg approach in mathematics learning. Thus, this research is expected to contribute to the development of more interactive and in-depth learning methods, which ultimately can improve the quality of mathematics learning in schools.

This research is expected to provide benefits both theoretically and practically. Theoretically, this research can add insight into the effectiveness of the use of technology-based learning media, especially interactive PPT, in improving students' understanding of mathematical concepts. In addition, this research also contributes to the development of Realistic Mathematics Education (RME)-based learning approaches, especially the Iceberg approach. Practically, the results of this study are expected to be a reference for mathematics teachers in designing and implementing more effective and interactive learning strategies, so that they can improve the quality of mathematics learning in schools.

RESEARCH METHODS

This study uses a quasi-experimental approach with a pre-test and post-test design involving two groups of students. The first group is an experimental group that will take part in learning using interactive PowerPoint (PPT) with the Iceberg approach, while the

second group is a control group that will take part in learning using conventional methods without using interactive PPT. This design was chosen to allow researchers to compare the improvement in understanding of mathematical concepts in the two groups.

The subject of the study was grade VIII students at a junior high school in Indonesia. Two classes were selected by purposive sampling, where one class became the experimental group and the other class became the control group. The total subjects involved in this study were 60 students, with each group consisting of 30 students. The selection of classes is carried out based on the level of equivalence of students' initial abilities as measured through previous math scores.

This research was carried out through several stages. The first stage is preparation, where researchers design interactive PowerPoint media that will be used by the experimental group. This media is designed based on the surface area of the tube by applying the Iceberg approach which starts from the concrete stage, such as the tube mesh model, to the abstract stage which involves understanding the tube surface area formula. In addition, the researcher also compiled pre-test and post-test questions to measure students' understanding before and after learning.

Furthermore, in the implementation stage, the experimental group will take part in learning using interactive PPT media, where students are involved in the visual and exploratory learning process, while the control group will follow learning with conventional methods involving lectures and discussions. The material presented is the same, but without the help of animation or interactive visualization. After the learning is complete, students from both groups will be given a post-test to measure their improvement in understanding of the concept of the surface area of the tube.

The research instruments used in this study consist of concept comprehension tests and questionnaires. The concept comprehension test includes questions related to the surface area of the tube, which aims to measure students' understanding from a concrete to abstract level. In addition, a questionnaire was provided for students in the experimental group to find out their perception of the effectiveness and involvement in the use of interactive PPT with the Iceberg approach.

The data obtained from the pre-test and post-test will be analyzed using statistical tests. First, a normality test was carried out to ensure that the data was distributed normally, followed by a variance homogeneity test. If both assumptions are met, a t-test is used to compare the difference in increased understanding between the experimental group and the control group. In addition, the data from the questionnaire will be analyzed descriptively to identify students' perceptions of the use of learning media used in this study. The design of this study uses a pre-test and post-test control group design, which allows researchers to compare the results of the pre-test and post-test between the two groups, as well as measure the effectiveness of the treatment given to the experimental group. This study is expected to provide a clear picture of the

influence of the use of interactive PPT with the Iceberg approach on students' understanding of mathematical concepts, especially on the surface area of the tube.

RESULTS AND DISCUSSION

Research Results

This study aims to determine the effect of the use of interactive PowerPoint (PPT) with the Iceberg approach on students' understanding of mathematical concepts on the surface area of the tube. This study involved two groups: an experimental group that used an interactive PPT with an Iceberg approach and a control group that used conventional learning methods. The following is the order of the research results.

1. Description of Research Data

The data collected consisted of the results of the pre-test and post-test conducted on two groups of students. The average pre-test score for the experimental group was 64, and after the treatment, the average post-test score increased to 90. Meanwhile, the control group experienced an increase from a pre-test score of 63 to 76 in the post-test. The table below summarizes the pre-test and post-test results of the two groups.

Table 1. Description of Research Results

Group	Average Pre-test	Average Post-test	Difference
Experiment	64	90	26
Control	63	76	13

From this data, it can be seen that the increase in concept understanding in the experimental group is more significant compared to the control group, which shows that the use of interactive PPT with the Iceberg approach is more effective in helping students understand the material of the surface area of the tube.

2. Normality and Homogeneity Test

Before conducting further analysis, a normality test was carried out using Kolmogorov-Smirnov to ensure that the data was normally distributed. The results of the analysis showed that the data from both groups were normally distributed, with a p-value greater than 0.05. The table below summarizes the results of the normality test.

Table 2. Summary of the Normality Test

Group	Pre-test p-value	Post-test p-value	Conclusion
Experiment	0,086	0,112	Normally distributed data
Control	0,075	0,109	Normally distributed data

Furthermore, a homogeneity test of variance was carried out using the Levene test. The test results showed that the variance of the two groups was homogeneous with p-value = 0.194. The following table summarizes the results of the homogeneity test.

Table 3. Homogeneity Test Summary

Group	Pre-test Variance	**Post-test Variance**	**p-value**	**Conclusion**
Experiment	58	91	0,194	Homogeneous
Control	60	82		

3. Hypothesis with t-Test

To test the difference between the two groups, statistical analysis was carried out using a t-test. The results of the t-test analysis showed a t-value = 5.05 with p-value = 0.000. A p-value of less than 0.05 indicates that there is a significant difference between the experimental group and the control group. The table below presents the results of the t-test analysis.

Table 4. Summary of Test t

Test Groups	Experimental Classes	**Control Classes**	**T value**	**p-value**
Average Pre-test	64	63	5,05	0,000
Average Post-test	90	76		

4. Normalized Gain Test

The normalized gain test was carried out to measure the improvement of students' understanding effectively between the pre-test and post-test. The normalized gain is calculated using the formula:

$$Normalized\ Gain = \frac{Postes - Pretes}{100 - pretes}$$

After the calculation, the normalized gain value for the experimental group was 0.78, while for the control group was 0.37. The following table summarizes the results of the normalized gain calculations.

Table 5. Summary of Normalized Gain results

Group	Normalized Gain	Criterion
Experiment	0,78	Tall
Control	0,37	Low

5. Questionnaire Results

In addition to the test analysis, this study also included a questionnaire to measure students' perception of the use of interactive PPT with the Iceberg approach.

The results of the questionnaire showed that most of the students in the experimental group gave positive responses to the use of this learning medium. A total of 83% of students stated that learning with interactive PPT is more interesting than conventional learning methods, 77% of students are easier to understand the concept of tube surface area with interactive PPT is more interesting than conventional learning methods and 87% of students Want to use similar media in the future, The table below summarizes the results of the questionnaire regarding student perception:

Table 2. Summary of Questionnaire Results

Statement	Strongly Agree	Agree	Quite agree	Disagree	Strongly disagree
Learning is more engaging with interactive PPTs	25	4	1	0	0
It is easier to understand the concept of the surface area of the tube	23	5	2	0	0
Want to use similar media in the future	26	3	1	0	0

The results of this questionnaire provide an overview that the use of interactive PPT not only has a positive impact on concept understanding, but can also increase student motivation and involvement in mathematics learning. Students feel more motivated to learn by using interesting and interactive media, thus creating a more dynamic and fun learning atmosphere.

Discussion of Research Results

This study aims to determine the effect of the use of interactive PowerPoint (PPT) with the Iceberg approach on students' understanding of mathematical concepts on the surface area of the tube. Based on the results of the research that has been conducted, it was found that the use of interactive PPT is significantly more effective than conventional learning methods in improving students' understanding of the material.

1. Improving Concept Understanding Through Interactive PPTs with the Iceberg Approach

The results of pre-test and post-test analysis showed that the experimental group that used interactive PPT with the Iceberg approach experienced a more significant increase in concept understanding compared to the control group. The average post-test score of the experimental group increased from 64 to 90, while the control group only increased from 63 to 76. This difference shows that the use of

technology-based interactive media is able to facilitate students in understanding complex geometric concepts, especially in the material of the surface area of the tube. Previous research supports these findings. Aloraini (2012) shows that the use of multimedia in learning can increase students' interest in learning and understanding because it combines interesting visual, audio, and animation elements. In the context of learning geometry, such as the surface area of a tube, the use of interactive visualization through PPT allows students to visualize the building elements of space more clearly and concretely, thus helping them make the association between physical shapes and more abstract mathematical formulas. This is in line with Iceberg's approach which allows students to start from concrete experiences before moving on to a more abstract understanding (Gravemeijer & Doorman, 1999).

2. The Effectiveness of the Iceberg Approach in Improving Concept Understanding

The Iceberg approach applied in this interactive PPT shows positive results in supporting step-by-step learning, where students are invited to understand concepts from the concrete stage to the abstract. This approach has been proven to help students connect their visual experience with a deeper understanding of the concept. Zulkardi and Ilma (2006) found that Iceberg's approach is very effective in improving students' understanding because it provides a strong conceptual foundation before introducing higher mathematical abstractions.

In this study, the use of the tube mesh model in the early stages of learning helps students understand the basic structure of the tube before they move on to its surface area formula. Through this gradual approach, students are able to build their knowledge progressively, thereby increasing their understanding of the material. The results of the higher normalized gain test in the experimental group (0.78) compared to the control group (0.37) support this, indicating that the improvement of understanding obtained through the Iceberg approach is more effective than conventional learning methods.

3. Students' Motivation and Perception of the Use of Interactive PPT

The results of the questionnaire showed that the majority of students in the experimental group gave a positive response to the use of interactive PPT with the Iceberg approach. A total of 88% of students stated that learning is more interesting, and 87% of students want to use similar media in the future. This shows that not only does the understanding of concepts increase, but also the students' learning motivation increases when they are faced with more interactive and dynamic learning media.

Research by Dwi et al. (2020) also shows that technology-based learning media is able to increase student learning motivation because of a more interesting and enjoyable learning experience. In this study, the use of animation and simulation features in interactive PPT triggers more active student involvement in the learning process. They not only listened to explanations, but also engaged in visual exploration, which increased their enthusiasm in understanding the material.

4. Consistency with Previous Research

The results of this study are consistent with previous studies that show that the use of interactive media and a gradual approach such as Iceberg is able to improve students' understanding of mathematics. Indriani (2015) revealed that many students have difficulty understanding geometric concepts such as the surface area of a tube because they tend to memorize formulas without understanding the meaning behind them. Through Iceberg's concrete, experience-based approach, students can understand not only formulas, but also the concepts behind them.

Mayer (2009) also supports this finding with the theory of multimedia learning, which states that students learn more effectively when they receive information through a combination of visual and verbal elements simultaneously. The use of interactive PPT in this study is in line with the theory, where students can visualize concepts and get verbal explanations simultaneously, thereby increasing information absorption.

CONCLUSION

This study shows that the use of interactive PowerPoint (PPT) with the Iceberg approach significantly improves students' understanding of mathematical concepts on the surface area of the tube. The experimental group that used the interactive PPT experienced an average increase of 26 points, while the control group that used the conventional method only increased by 13 points. The results of t-test ($t = 5.05$ and $p = 0.000$) and normalized gain (experimental group = 0.78 and control group = 0.37) show that this approach is more effective in improving concept understanding. In addition, the results of the questionnaire showed that 83% of students felt more motivated and interested in learning using interactive PPT. In conclusion, interactive PPTs with the Iceberg approach are effective not only in improving conceptual understanding, but also in motivating students to be more active in learning mathematics.

BIBLIOGRAPHY

Aloraini, S. (2012). The impact of using multimedia on students' academic achievement in the College of Education at King Saud University. *Journal of King Saud University - Languages and Translation*, 24(2), 75-82.

Aloraini, S. (2012). *The impact of using multimedia on students' academic achievement in the College of Education at King Saud University*. Journal of King Saud University - Languages and Translation, 24(2), 75-82.

Dwi, W., Prasetyo, R., & Suparman, S. (2020). The influence of technology-based learning media on students' motivation to learn mathematics. *Journal of Mathematics Education*, 8(3), 120-132.

Dwi, W., Prasetyo, R., & Suparman, S. (2020). *The influence of technology-based learning media on students' motivation to learn mathematics*. Journal of Mathematics Education, 8(3), 120-132.

Gravemeijer, K., & Doorman, M. (1999). Context problems in realistic mathematics education: A calculus course as an example. *Educational Studies in Mathematics*, 39(1), 111-129.

Gravemeijer, K., & Doorman, M. (1999). *Context problems in realistic mathematics education: A calculus course as an example*. Educational Studies in Mathematics, 39(1), 111-129.

Indriani, D. (2015). Analysis of students' difficulties in understanding the concept of tube surface area. *Journal of Mathematics Education*, 9(2), 50-58.

Indriani, D. (2015). *Analysis of students' difficulties in understanding the concept of tube surface area*. Journal of Mathematics Education, 9(2), 50-58.

Mayer, R. E. (2009). Multimedia learning (2nd ed.). Cambridge University Press.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.

Prabowo, A. (2018). The influence of the iceberg approach on students' understanding of geometry. *Journal of Mathematics Education*, 12(1), 22-35.

Van den Heuvel-Panhuizen, M. (2003). The didactical use of models in realistic mathematics education: An example from a longitudinal trajectory on percentage. *Educational Studies in Mathematics*, 54(1), 9-35.

Zulkardi & Ilma, R. (2006). *Improving mathematical understanding through the Realistic Mathematics Education (RME) approach*. Journal of Mathematics Education and Learning, 12(2), 31-45.

Zulkardi, & Ilma, R. (2006). Improving mathematical understanding through the Realistic Mathematics Education (RME) approach. *Journal of Mathematics Education and Learning*, 12(2), 31-45.